

STATISTICS

1. Measures of Central Tendency

Mode, median and mean

For a sample of discrete data, the **mode** is the observation, x with the highest frequency, f .

For grouped data in a cumulative frequency table, the **median** = $L + \left[\frac{\frac{1}{2}N - F}{f_m} \right] C$

where L is the lower boundary of the median class

N is total frequency

F is the cumulative frequency before the median class

C is the interval of the median class

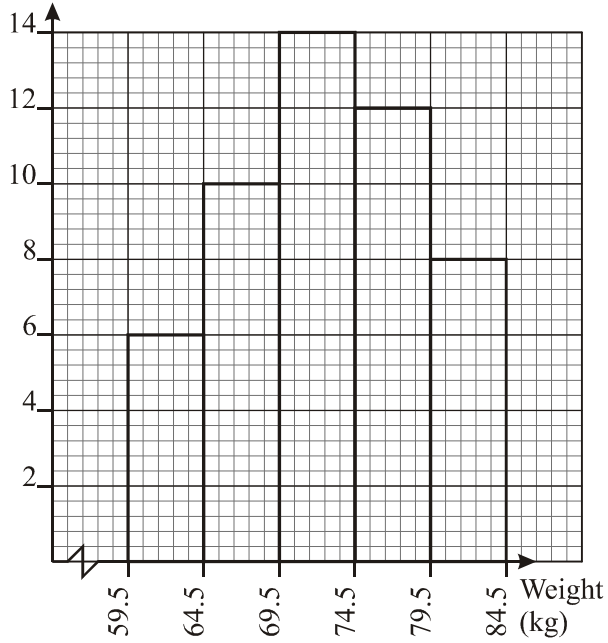
f_m is the frequency of the median class

The **mean** is the average of all the observations. Hence, $\bar{x} = \frac{\sum x}{N}$. For grouped data, $\bar{x} = \frac{\sum f x}{\sum f}$.

<p>(a) Find the mode, median and mean for 2, 3, 1, 2, 6, 8, 9, 3, 2, 3.</p> <p style="text-align: right;">[Mode = 2, Median = 3, Mean = 4]</p>	<p>(b) Find the mode, median and mean for the data in the table below.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <td>Score</td> <td>2</td> <td>4</td> <td>6</td> <td>9</td> <td>12</td> <td>13</td> </tr> <tr> <td>Frequency</td> <td>1</td> <td>3</td> <td>2</td> <td>1</td> <td>2</td> <td>1</td> </tr> </table> <p style="text-align: right;">[Mode = 4, Median = 6, Mean = 7.2]</p>	Score	2	4	6	9	12	13	Frequency	1	3	2	1	2	1										
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<p>(c) Find the modal class and calculate the median and mean for the data in the table below.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <td>Points</td> <td>0 - 4</td> <td>5 - 9</td> <td>10 - 14</td> <td>15 - 19</td> </tr> <tr> <td>frequency</td> <td>2</td> <td>5</td> <td>8</td> <td>3</td> </tr> </table> <p style="text-align: right;">[Modal class = 10-14, Median = 10.75, Mean = 10.33]</p>	Points	0 - 4	5 - 9	10 - 14	15 - 19	frequency	2	5	8	3	<p>(d) Find the modal class and calculate the median and mean for the data in the table below.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <td>Marks</td> <td>1 - 15</td> <td>16 - 30</td> <td>31 - 45</td> <td>46 - 60</td> <td>61 - 75</td> <td>76 - 90</td> </tr> <tr> <td>f</td> <td>8</td> <td>11</td> <td>25</td> <td>34</td> <td>16</td> <td>6</td> </tr> </table> <p style="text-align: right;">[Modal class = 46-60, Median = 48.15, Mean = 46.53]</p>	Marks	1 - 15	16 - 30	31 - 45	46 - 60	61 - 75	76 - 90	f	8	11	25	34	16	6
Points	0 - 4	5 - 9	10 - 14	15 - 19																					
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(e) Estimate the mode and calculate the median and mean for the histogram below.

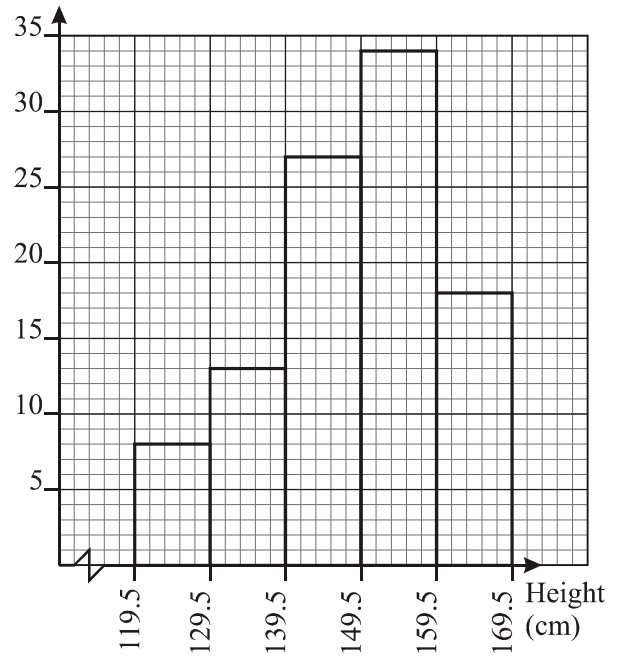
No. of students (f)



[Mode = 72.8, Median = 72.71, Mean = 72.6]

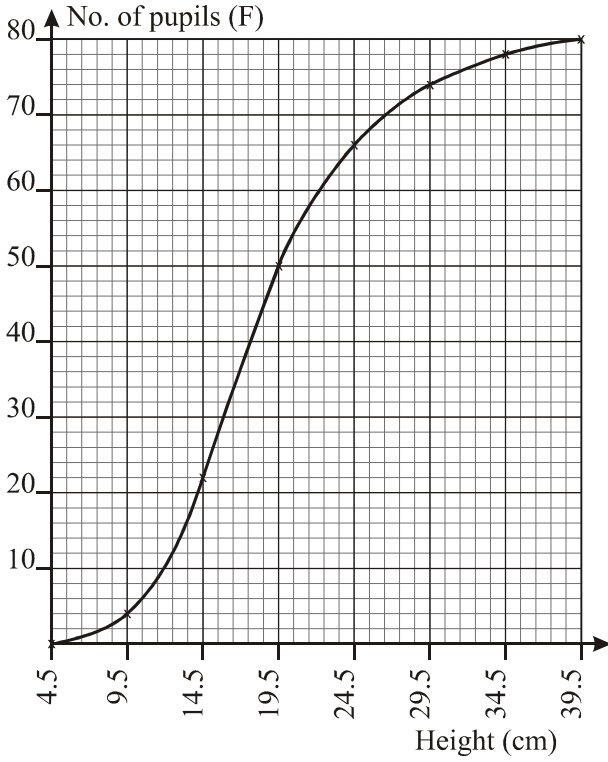
(f) Estimate the mode and calculate the median and mean for the histogram below.

No. of pupils (f)



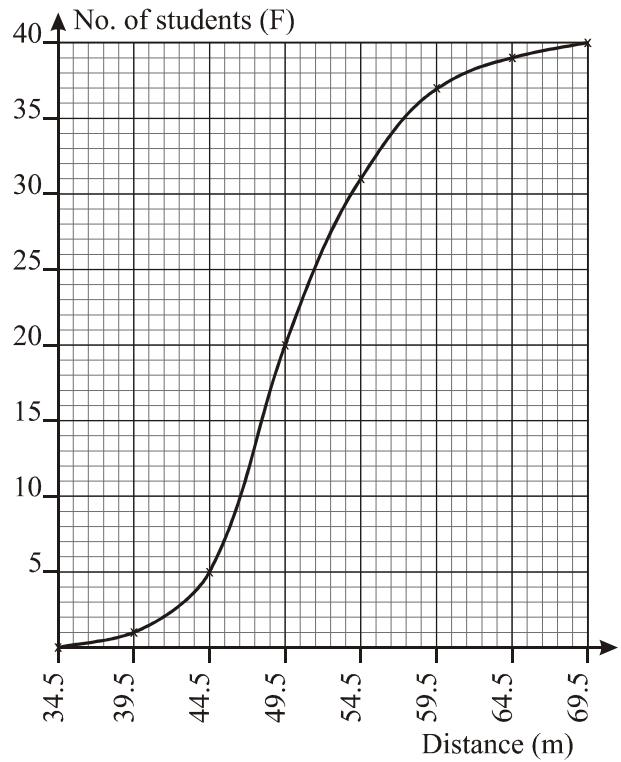
[Mode = 152.5, Median = 150.09, Mean = 149.12]

(g) Find the modal class and find the median and mean for the ogive below.



[Modal class = 15-19, Median = 17.6, Mean = 18.625]

(h) Find the modal class and find the median and mean for the ogive below.



[Modal class = 45-49, Median = 49.5, Mean = 50.25]

2. Measures of Dispersion:

Range, quartiles, interquartile range, variance and standard deviation.

The **range** of a sample is the difference between the observations with the highest value and the lowest value.

The **first quartile**, $Q_1 = L_{Q_1} + \left[\frac{\frac{1}{4}N - F}{f_{Q_1}} \right] C_{Q_1}$ and the **third quartile**, $Q_3 = L_{Q_3} + \left[\frac{\frac{1}{4}N - F}{f_{Q_3}} \right] C_{Q_3}$

Interquartile range = $Q_3 - Q_1$. It should be recognised that the median is Q_2 .

The **variance**, $\sigma^2 = \frac{\sum(x - \bar{x})^2}{N} = \frac{\sum x^2}{N} - \bar{x}^2$ for discrete data.

For grouped data, $\sigma^2 = \frac{\sum(fx - \bar{x})^2}{\sum f} = \frac{\sum f x^2}{\sum f} - \bar{x}^2$.

The **standard deviation** is actually $\sqrt{\text{variance}} = \sigma$

For discrete data, $\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{N}} = \sqrt{\frac{\sum x^2}{N} - \bar{x}^2}$.

For grouped data, $\sigma = \sqrt{\frac{\sum(fx - \bar{x})^2}{\sum f}} = \sqrt{\frac{\sum f x^2}{\sum f} - \bar{x}^2}$.

<p>(a) Find the range and the interquartile for 5, 1, 2, 3, 4, 6, 3, 8, 2, 5, 9.</p> <p style="text-align: right;">[Range = 8, Interquartile range = 4]</p>	<p>(b) Find the range and the interquartile range for 12, 17, 13, 19, 15, 8, 12, 11.</p> <p style="text-align: right;">[Range = 11, Interquartile range = 4.5]</p>																								
<p>(c) Find the range and the interquartile for</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>Score</td> <td>1</td> <td>4</td> <td>5</td> <td>6</td> <td>8</td> <td>9</td> </tr> <tr> <td>Frequency</td> <td>1</td> <td>3</td> <td>1</td> <td>1</td> <td>2</td> <td>1</td> </tr> </tbody> </table> <p style="text-align: right;">[Range = 8, Interquartile range = 4]</p>	Score	1	4	5	6	8	9	Frequency	1	3	1	1	2	1	<p>(d) Find the range and the interquartile range for</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>Points</td> <td>2</td> <td>4</td> <td>6</td> <td>8</td> </tr> <tr> <td>No. of person</td> <td>3</td> <td>5</td> <td>2</td> <td>2</td> </tr> </tbody> </table> <p style="text-align: right;">[Range = 6, Interquartile range = 3]</p>	Points	2	4	6	8	No. of person	3	5	2	2
Score	1	4	5	6	8	9																			
Frequency	1	3	1	1	2	1																			
Points	2	4	6	8																					
No. of person	3	5	2	2																					

(e) Find the interquartile range for the table below.

Marks	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
No. of Students	4	9	12	10	5

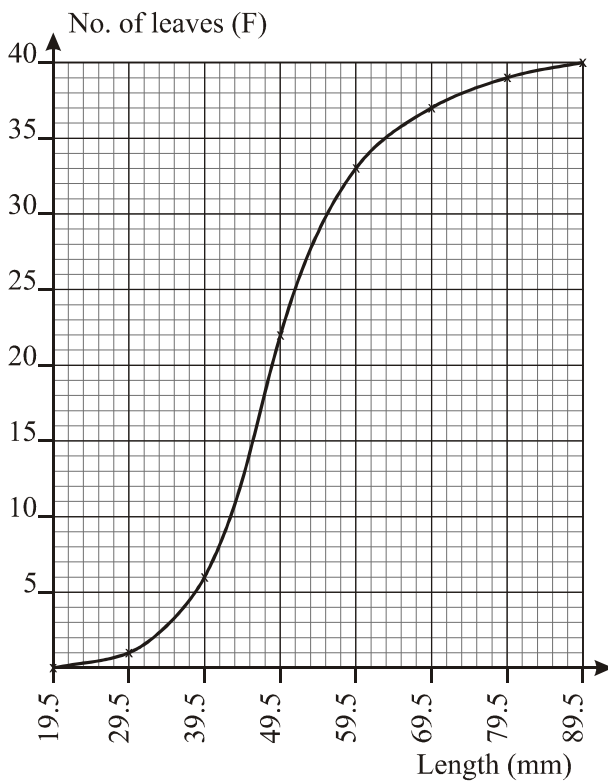
[Interquartile range = 40.77 marks]

(f) Find the interquartile range for the table below.

Age (year)	1-20	21-40	41-60	61-80
No. of residents	66	99	57	28

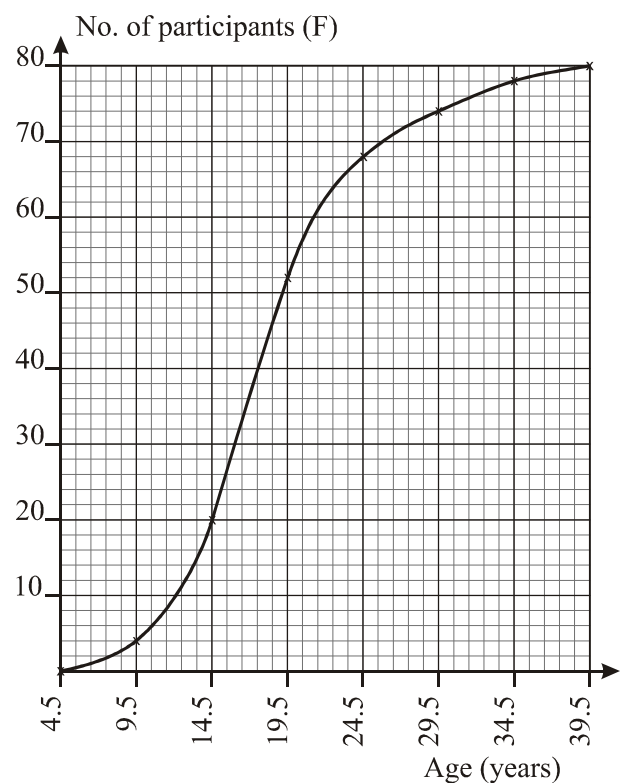
[Interquartile range = 28.95 years]

(e) Calculate the interquartile range for the ogive below.



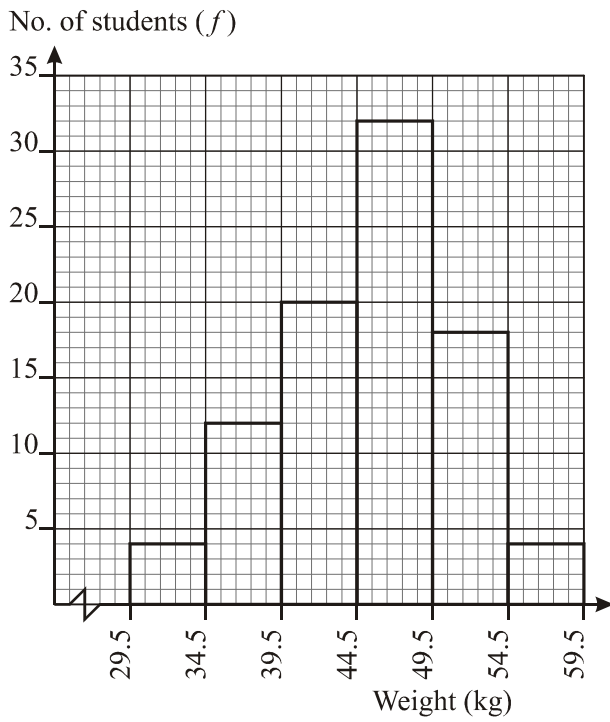
[Interquartile range = 12.5 mm]

(f) Calculate the interquartile range for the ogive below.



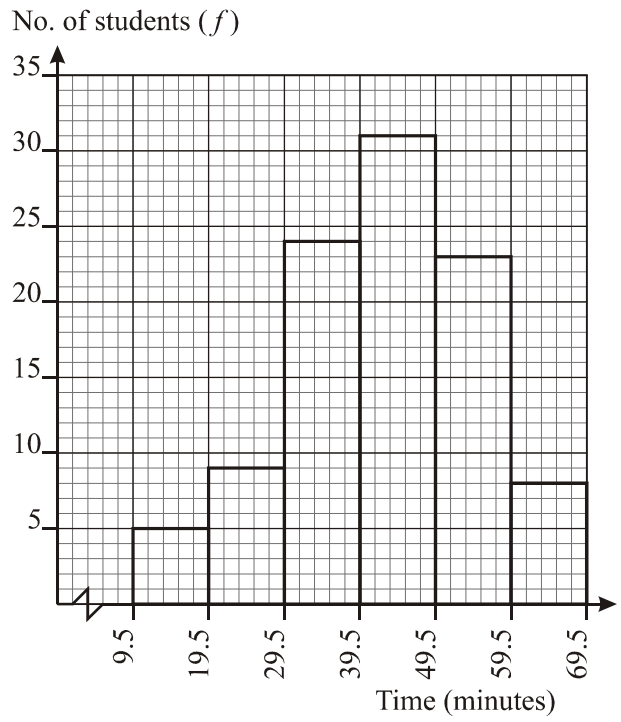
[Interquartile range = 6.5 years]

(g) Calculate the interquartile range for the histogram below.



[Interquartile range = 5.295 kg]

(h) Calculate the interquartile range for the histogram below.



[Interquartile range = 18.03 minutes]

<p>(a) Find the mean, variance and the standard deviation for the data below. 5, 12, 6, 3, 6, 10.</p> <p style="text-align: right; margin-top: 200px;">[Mean = 7, $\sigma^2 = 9.333$, $\sigma = 3.055$]</p>	<p>(b) Find the mean, variance and the standard deviation for the data below. 18, 12, 16, 11, 19, 18, 12, 14.</p> <p style="text-align: right; margin-top: 200px;">[Mean = 15, $\sigma^2 = 7.5$, $\sigma = 2.739$]</p>																																																																																																
<p>(c) Complete the table below and calculate the mean, variance and the standard deviation for the data.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>Σ</td></tr> <tr><td>f</td><td>1</td><td>3</td><td>4</td><td>7</td><td>3</td><td>2</td><td></td></tr> <tr><td>fx</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>$\bar{x} - x$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>$(\bar{x} - x)^2$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>$f(\bar{x} - x)^2$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p style="text-align: right; margin-top: 200px;">[Mean = 7, $\sigma^2 = 9.333$, $\sigma = 3.055$]</p>	x	1	2	3	4	5	6	Σ	f	1	3	4	7	3	2		fx								$\bar{x} - x$								$(\bar{x} - x)^2$								$f(\bar{x} - x)^2$								<p>(d) Complete the table below and calculate the mean, variance and the standard deviation for the data.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr><td>x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>Σ</td></tr> <tr><td>f</td><td>1</td><td>2</td><td>2</td><td>2</td><td>1</td><td>2</td><td></td></tr> <tr><td>fx</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>$\bar{x} - x$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>$(\bar{x} - x)^2$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>$f(\bar{x} - x)^2$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p style="text-align: right; margin-top: 200px;">[Mean = 7.2, $\sigma^2 = 10.66$, $\sigma = 3.265$]</p>	x	2	4	6	8	10	12	Σ	f	1	2	2	2	1	2		fx								$\bar{x} - x$								$(\bar{x} - x)^2$								$f(\bar{x} - x)^2$							
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(e) Complete the table below and calculate the mean, variance and the standard deviation for the data.

Class	1 - 3	4 - 6	7 - 9	10 - 12	13 - 15	Σ
f	1	3	8	6	2	
x						
fx						
x^2						
fx^2						

[Mean = 8.75, $\sigma^2 = 8.8875$, $\sigma = 2.981$]

(f) Complete the table below and calculate the mean, variance and the standard deviation for the data.

Class	10 - 19	20 - 29	30 - 39	40 - 49	Σ
f	5	7	5	3	
x					
fx					
x^2					
fx^2					

[Mean = 27.5, $\sigma^2 = 101$, $\sigma = 10.05$]

(g) Complete the table below and calculate the mean, variance and the standard deviation for the data.

Class	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	Σ
f	3	13	23	9	2	
x						
fx						
x^2						
fx^2						

[Mean = 12.4, $\sigma^2 = 20.64$, $\sigma = 4.543$]

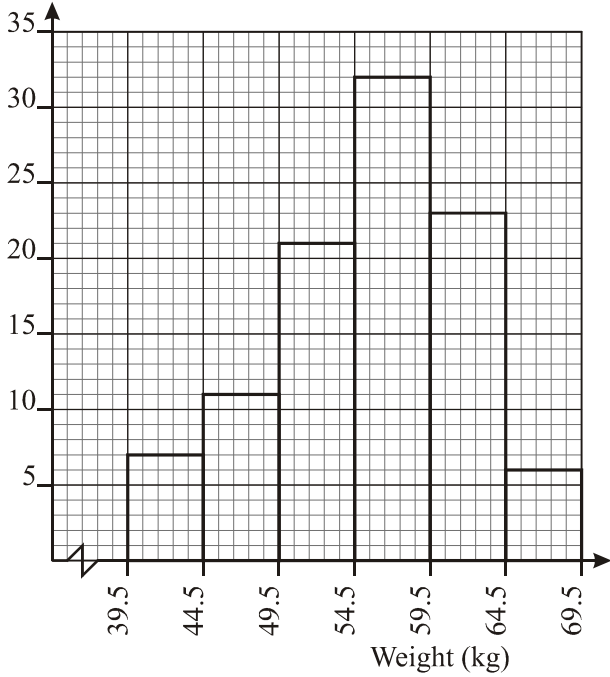
(h) Complete the table below and calculate the mean, variance and the standard deviation for the data.

Class	0 - 19	20 - 39	40 - 59	60 - 79	Σ
f	4	7	6	3	
x					
fx					
x^2					
fx^2					

[Mean = 37.5, $\sigma^2 = 376$, $\sigma = 19.39$]

(i)

No. of students (f)



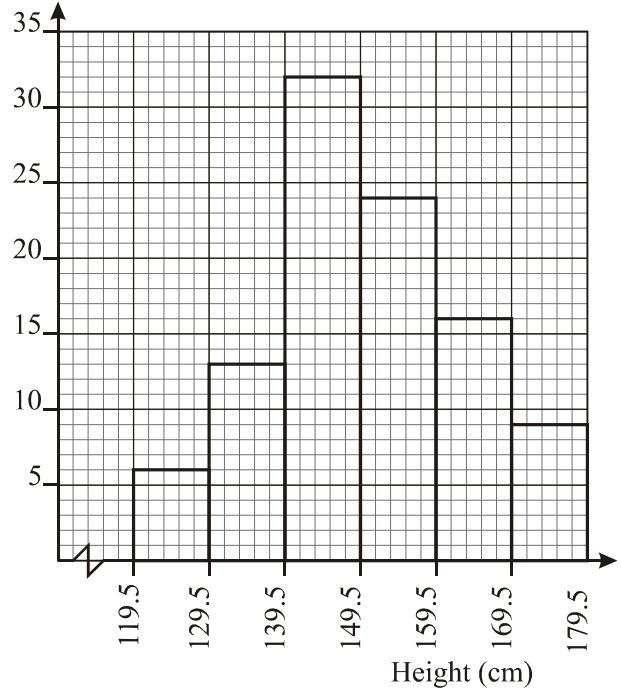
Extract the data from the histogram above and complete the table below. Calculate the mean, variance and the standard deviation for the data.

Class	x	f	fx	fx^2
Σ				

[Mean = 55.55, $\sigma^2 = 41.6475$, $\sigma = 6.453$]

(j)

No. of pupils (f)



Extract the data from the histogram above and complete the table below. Calculate the mean, variance and the standard deviation for the data.

Class	x	f	fx	fx^2
Σ				

[Mean = 150.3, $\sigma^2 = 172.36$, $\sigma = 13.13$]